



ELECTRONICS

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Product Information

**DATE : 14. May. 2010****SAMSUNG TFT-LCD****MODEL : LTA260AP07**

The Information Described in this Specification is Preliminary and can be changed without prior notice

APPROVAED BY	DATE	PREPARED BY	DATE
	14. May, 2010	Jeong-Geun Han	14. May, 2010

**LCD Business****Samsung Electronics Co . , LTD.**

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## General Description

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### Description

LTA260AP07 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT(Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 26.0" is 1366 x 768 and this model can display up to 16.7 million colors with wide viewing angle of 89° or higher in all directions. This panel is intended to support applications to provide a excellent performance for Flat Panel Display such as Home-alone Multimedia TFT-LCD TV and High Definition TV.

### Features

- RoHS compliance (Pb-free)
- High contrast & aperture ratio with wide color gamut
- APVA( Advanced Patterned Vertical Align) mode
- Wide viewing angle ( $\pm 178^\circ$ )
- High speed response
- HD resolution (16:9)
- Low Power consumption
- U-Type 4 CCFLs (Cold Cathode Fluorescent Lamp)
- DE(Data Enable) mode
- LVDS (Low Voltage Differential Signaling) interface (1pixel/clock)

## General Information

Items	Specification	Unit	Note
Module Size	626.0(H <sub>TYP</sub> ) x 373.0(V <sub>TYP</sub> )	mm	$\pm 1.0\text{mm}$
	53.0(D <sub>Max</sub> )		
Weight	5,300 (Max)	g	
Pixel Pitch	0.4215(H) x 0.4215(V)	mm	
Active Display Area	575.769(H) x 323.712(V)	mm	
Surface Treatment	Antiglare, Hard-coating (3H)		
Display Colors	8 bit - 16.7M	colors	
Number of Pixels	1,366 x 768	pixel	
Pixel Arrangement	RGB Horizontal stripe		
Display Mode	Normally Black		
Luminance of White	400nit (Typ.)	cd/m <sup>2</sup>	

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## 1. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	$V_{DD}$	GND-0.5	13.2	V	(1)
Dimming control	Max. Lum	-	5	V	(1)
Storage temperature	$T_{STG}$	-20	60	°C	(2)
Surface temperature	$T_{SUR}$	0	60	°C	(3)
Operation temperature	$T_{OPR}$	0	50	°C	(2)
Shock ( non - operating )	$S_{nop}$	-	50	G	(4)
Vibration ( non - operating )	$V_{nop}$	-	1.5	G	(5)

Note (1)  $T_a = 25 \pm 2$  °C

(2) Temperature and relative humidity range are shown in the figure below.

a. 90 % RH Max. ( $T_a \leq 39$  °C)

b. Relative Humidity is 90% or less. ( $T_a > 39$  °C)

c. No condensation

(3) Although abnormal visual problems can be occurred in  $T_{sur}$  range, the polarizer is not damaged in this range.

(4) 11ms, sine wave, one time for  $\pm X, \pm Y, \pm Z$  axis

(5) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

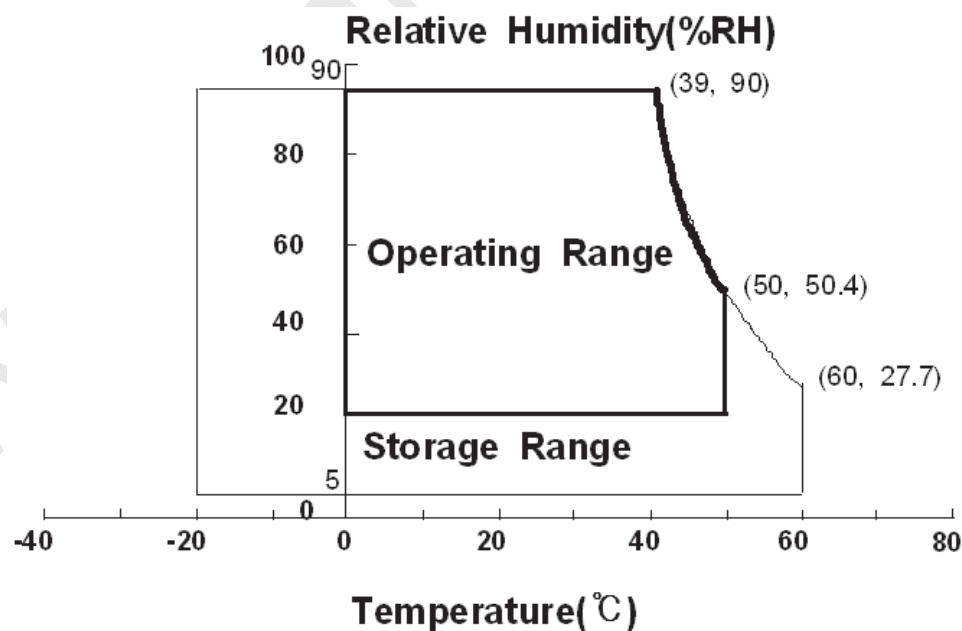


Fig. Temperature and Relative humidity range

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## 2. Optical Characteristics

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The optical characteristics should be measured in a dark room or equivalent.

Measuring equipment : TOPCON RD-80S, TOPCON SR-3, ELDIM EZCONTRAST

(Ta = 25 ± 2 °C, VDD=12.0V, fv= 60Hz, f<sub>DCLK</sub>=78 MHz, Dimming = Max )

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R	Normal $\theta L, R=0$ $\theta U, D=0$  Viewing Angle	2000	3000	-		(1) SR-3
Response Time	G-to-G	Tg		-	8	-	msec	(3) RD-80S
Luminance of White (Center of screen)		Y <sub>L</sub>		350	400	-	cd/m <sup>2</sup>	(4) SR-3
Color Chromaticity (CIE 1931)	Red	R <sub>x</sub>		TYP. -0.03	0.643	TYP. +0.03		(5),(6) SR-3
		R <sub>y</sub>			0.336			
	Green	G <sub>x</sub>			0.285			
		G <sub>y</sub>			0.600			
	Blue	B <sub>x</sub>			0.147			
		B <sub>y</sub>			0.065			
	White	W <sub>x</sub>			0.280			
		W <sub>y</sub>	0.290					
Color Gamut		-	-	72	-	%	(5) SR-3	
Color Temperature		-	-	10,000	-	K	(5) SR-3	
Viewing Angle	Hor.	θ <sub>L</sub>	C/R≥10	75	89	-	Degree	(6) EZ-Contrast
		θ <sub>R</sub>		75	89	-		
	Ver.	θ <sub>U</sub>		75	89	-		
		θ <sub>D</sub>		75	89	-		
Brightness Uniformity (9 Points)		B <sub>uni</sub>		-	-	25	%	(2) SR-3

### - Test Equipment Setup

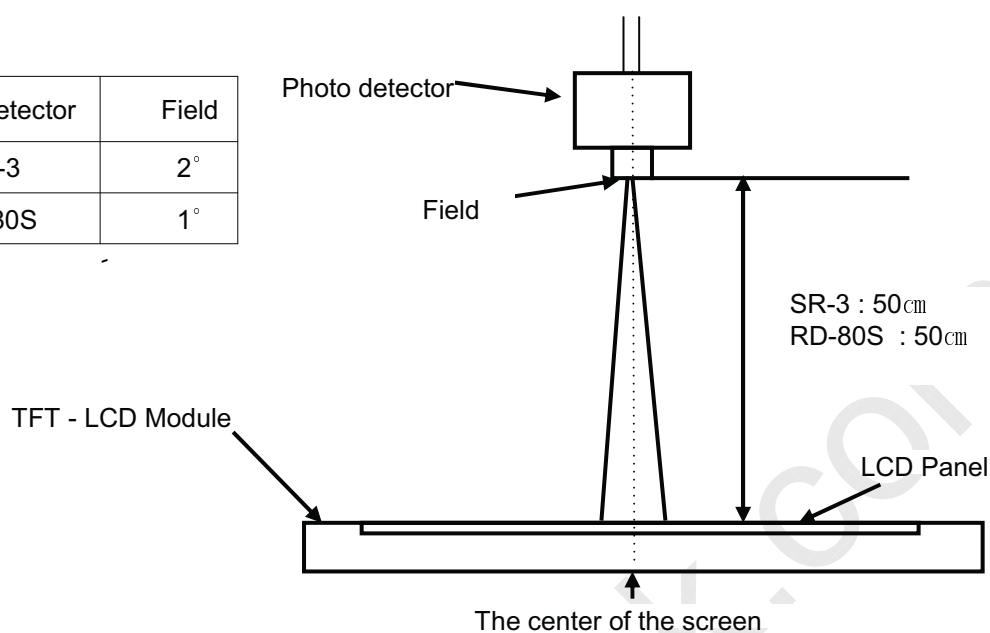
The measurement should be executed in a stable, windless and dark room between 40min and 60min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

Environment condition : Ta = 25 ± 2 °C

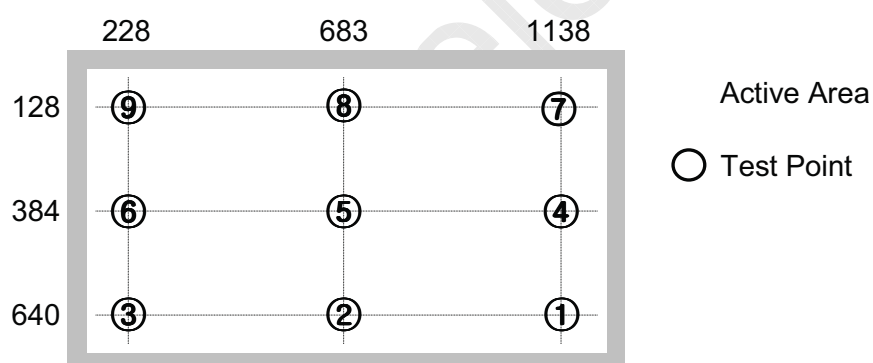
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Photo detector	Field
SR-3	2°
RD-80S	1°



- Definition of test point



Note (1) Definition of Contrast Ratio (C/R)

: Ratio of gray max (Gmax) &amp; gray min (Gmin) at the center point ⑤ of the panel

$$C/R = \frac{G_{\max}}{G_{\min}}$$

Gmax : Luminance with all pixels white

Gmin : Luminance with all pixels black

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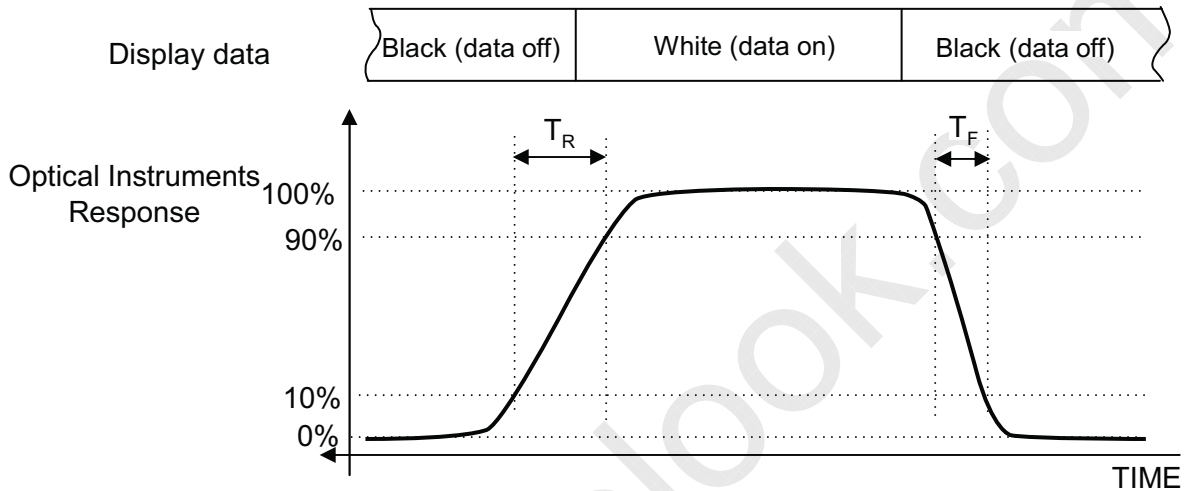
Note (2) Definition of 9 points brightness uniformity ( Test Pattern : Full White )

$$B_{uni} = 100 * \frac{(B_{max} - B_{min})}{B_{max}}$$

B<sub>max</sub> : Maximum brightness

B<sub>min</sub> : Minimum brightness

Note (3) Definition of Response time : Sum of T<sub>r</sub>, T<sub>f</sub>



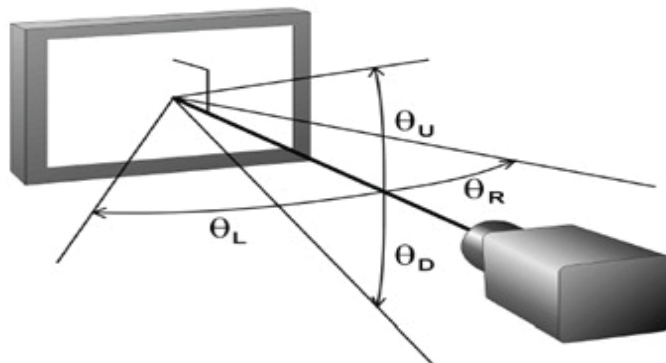
Note (4) Definition of Luminance of White : Luminance of white at center point ⑤

Note (5) Definition of Color Chromaticity (CIE 1931)

Color coordinate of Red, Green, Blue & White at center point ⑤

Note (6) Definition of Viewing Angle

: Viewing angle range (C/R ≥ 10)



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### 3. Electrical Characteristics

#### 3.1 TFT LCD Module

The connector for display data & timing signal should be connected.

$T_a = 25^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply	$V_{DD}$	10.8	12.0	13.2	V	(1)
Current of Power Supply	(a) Black	-	700	-	mA	(2),(3)
	(b) White	-	700	-	mA	
	(c) V-Stripe	-	800	1000	mA	
Vsync Frequency	$f_V$	48	60	66	Hz	
Hsync Frequency	$f_H$	44	48	53	kHz	
Main Frequency	$f_{DCLK}$	72	78	85	MHz	
Rush Current	$I_{RUSH}$	-	-	4	A	(4)

Note (1) The ripple voltage should be controlled under 10% of  $V_{DD}$ .

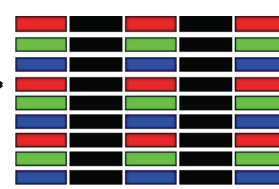
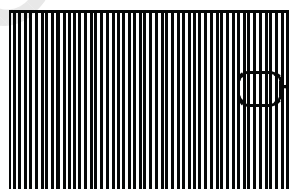
(2)  $f_V=60\text{Hz}$ ,  $f_{DCLK} = 78\text{ MHz}$ ,  $V_{DD} = 12.0\text{V}$ , DC Current.

(3) Power dissipation check pattern (LCD Module only)

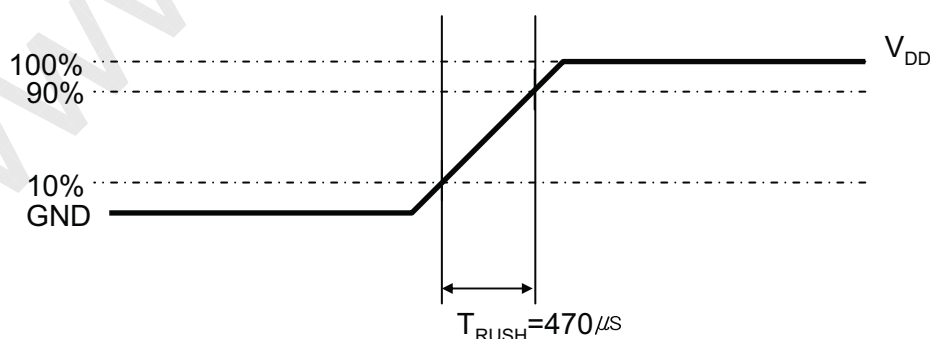
a) Black Pattern

b) White Pattern

c) V-Stripe



(4) Measurement Conditions



Rush Current  $I_{RUSH}$  can be measured when  $T_{RUSH}$  is  $470\mu\text{s}$ .

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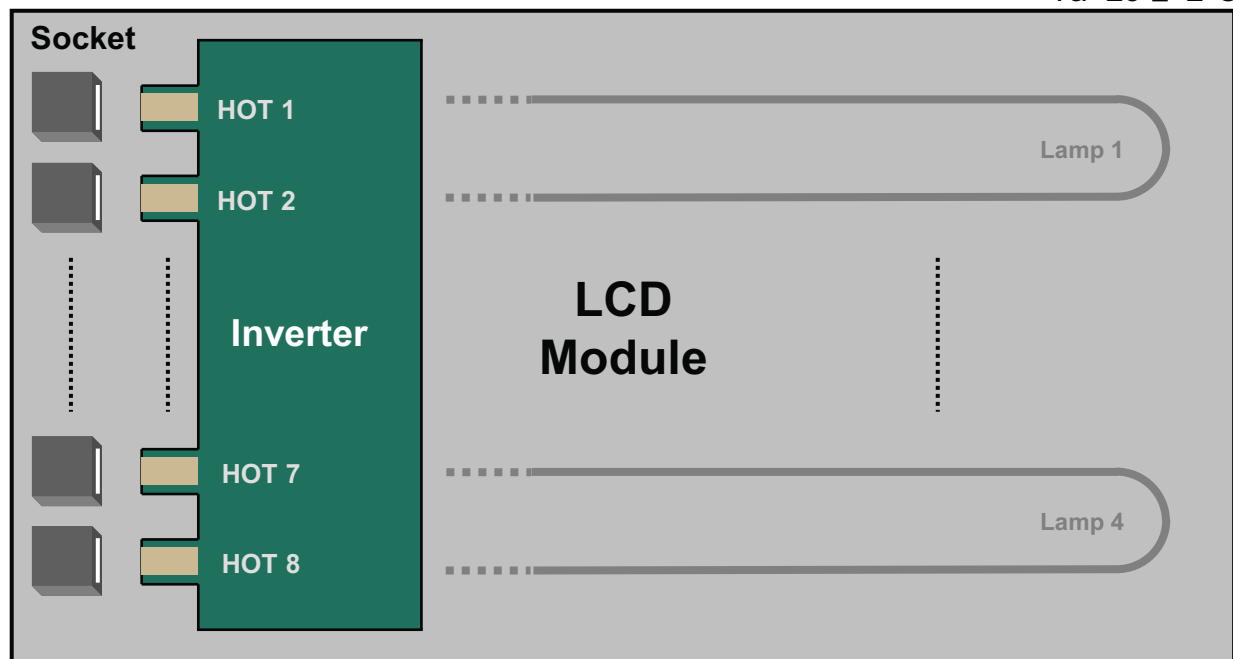
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### 3.2 Back Light Unit

The back light unit contains 4 direct-lighting U-type CCFLs ( Cold Cathode Fluorescent Lamp ).

 $T_a = 25 \pm 2^\circ\text{C}$ 

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Life Time	Hr	50,000	-	-	Hour	(1)

Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value.

[Operating condition :  $T_a = 25 \pm 2^\circ\text{C}$ , For single lamp only. ]

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## 3.3 Inverter Input Condition &amp; Specification

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Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Input Voltage	V <sub>IN</sub>	-	22	24	26	V	Ta=25± 2 °C (2)
Input Current	I <sub>IN</sub>	V <sub>IN</sub> =24.0V V <sub>dim</sub> =3.3V	-	-	2.2	A	(1),(2)
Lamp Current	I <sub>O,MAX</sub>	V <sub>dim</sub> =3.3 V	7.1	7.6	8.1	mArms	
Frequency	F <sub>LAMP</sub>	V <sub>IN</sub> =24.0 V	61	63	65	kHz	-
Backlight On/Off	ON	V <sub>IN</sub> =24.0 V	2.4	-	5.25	V	(3)
	OFF	V <sub>IN</sub> =24.0 V	0	-	0.8		
Dimming Control	V <sub>DIM</sub>	Max Lum	3.3	-	-	V	(3)
		Min. Lum	-	-	0		
PWM Voltage	V <sub>PWM</sub>	Max	3.0	-	5.0	V	(3)
		Min	0.0	-	0.4		
PWM Frequency	F <sub>PWM</sub>	V <sub>IN</sub> =24.0 V	140	150	160	Hz	
PWM Duty	Duty	V <sub>IN</sub> =24.0 V	20	-	100	%	(4)

Note) Power Consumption is measured when 400 [cd/m ] of luminance which is the typical luminance.

Lamp Current is measured at the point before Lamp.

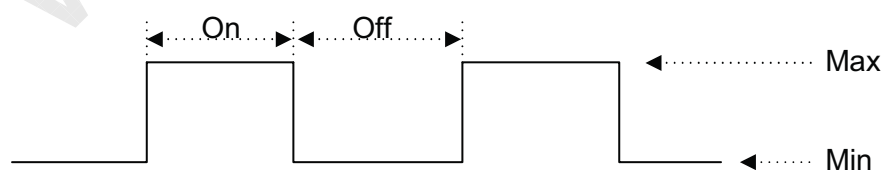
(1) Max Value of the Power Consumption is measured during initial turn on time\* of the backlight

(2) Max Value of the Power Consumption is measured after 60 min warm-up.

(3) The ripple voltage should be controlled under 10% of Input Signal

(4) Duty = On/(On+Off) \* 100

\* Initial turn-on time : From 0sec to 60min after turn-on



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## 4. Input Terminal Pin Assignment

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### 4.1. Input Signal & Power

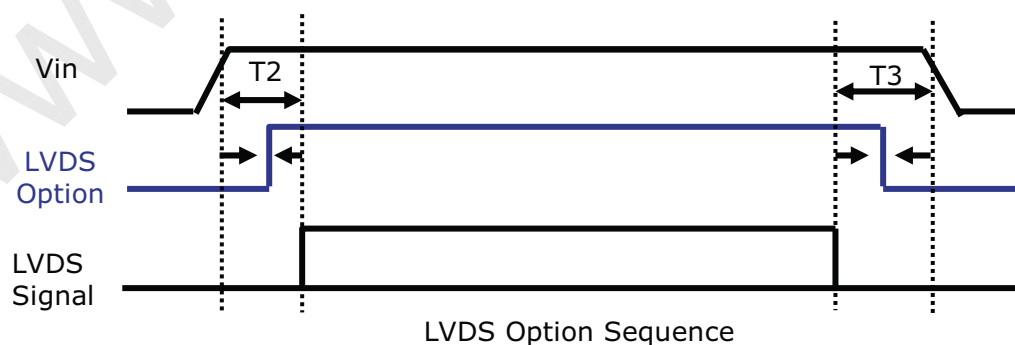
Connector : IS100-L30O-C23(UJU) or Compatible

PIN No.	Description	PIN No.	Description
1	No Connection	16	GND
2	No Connection	17	RxIN3-
3	No Connection	18	RxIN3+
4	GND	19	GND
5	RxIN0-	20	No Connection
6	RxIN0+	21	LVDS OPTION (Note 2)
7	GND	22	No Connection
8	RxIN1-	23	No Connection
9	RxIN1+	24	No Connection
10	GND	25	GND
11	RxIN2-	26	Vin
12	RxIN2+	27	Vin
13	GND	28	Vin
14	RxCLK-	29	Vin
15	RxCLK+	30	Vin

Note)(1) No Connection: This PINS are only used for SAMSUNG internal using.

(2) LVDS OPTION : If this PIN : HIGH (3.3 V) → Normal LVDS format  
: LOW (GND) → JEIDA LVDS format

SEQUENCE : On =  $V_{DD}(T1) \geq \text{LVDS Option} \geq \text{Interface Signal}(T2)$   
OFF =  $\text{Interface Signal}(T3) \geq \text{LVDS Option} \geq V_{DD}$



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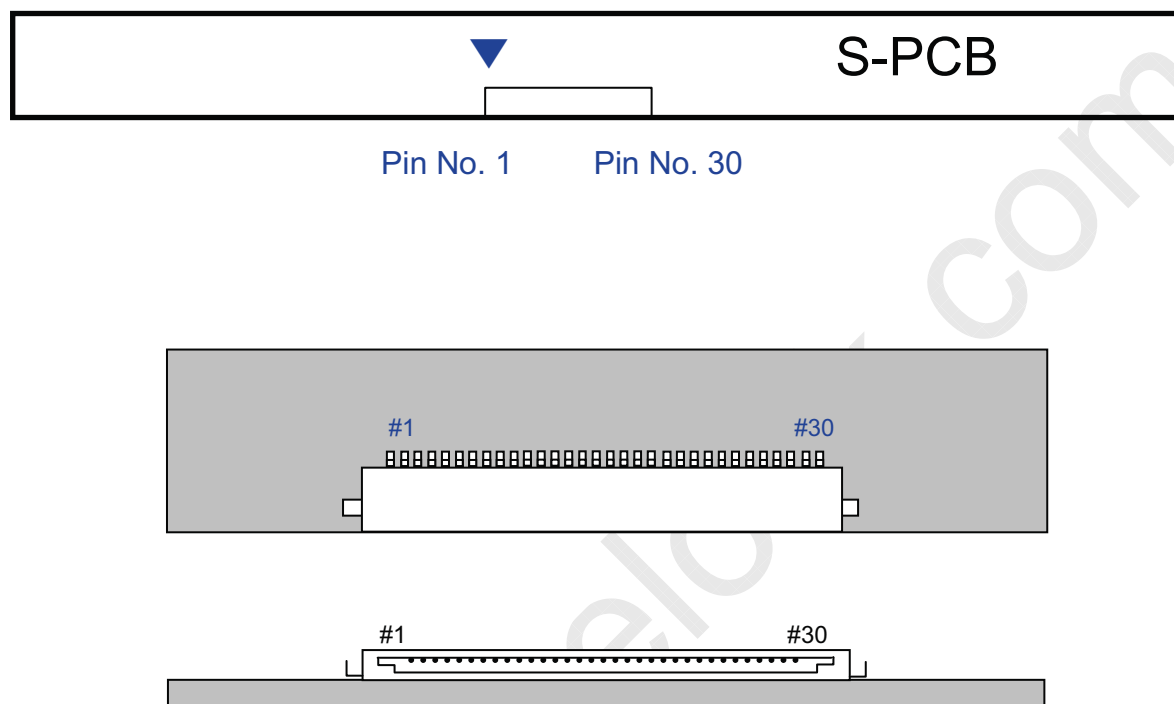
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Note(3) Pin number starts from Right side



**Fig. Connector diagram**

- All GND pins should be connected together and also be connected to the LCD's metal chassis.
- All power input pins should be connected together.
- All NC pins should be separated from other signal or power.

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## 4.2. Inverter Input Pin Configuration

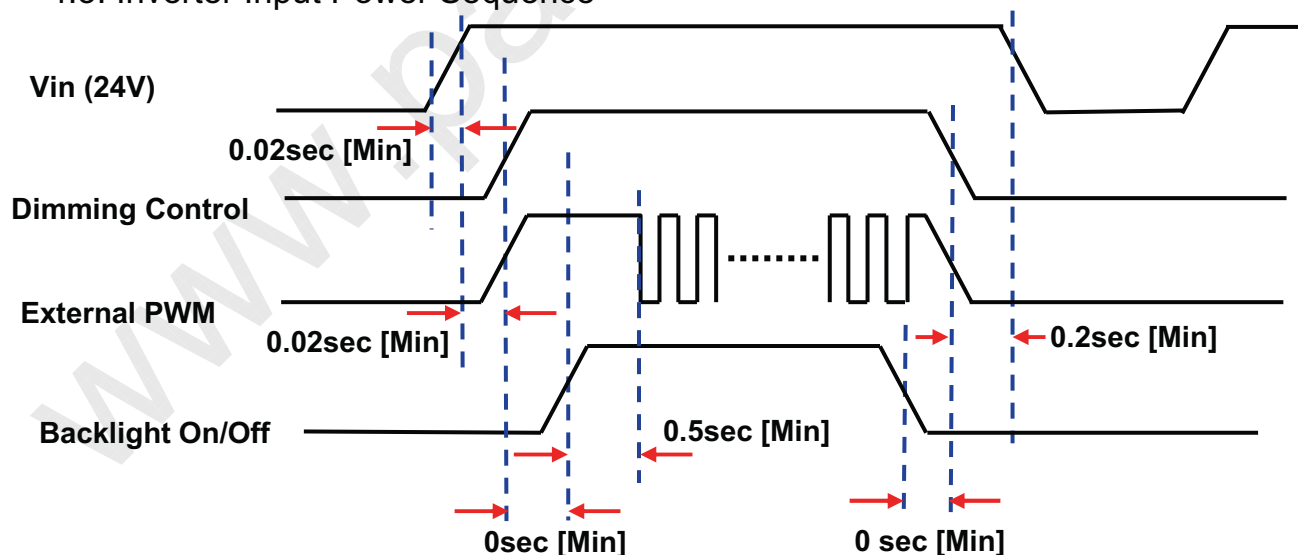
Connector : 20022WR-14AML (Yeon-ho)

Pin No.	Pin Configuration(FUNCTION)
1	24 V
2	24 V
3	24 V
4	24 V
5	24 V
6	GND
7	GND
8	GND
9	GND
10	GND
11	No Connection
12	Backlight On /Off [ON:2.4 – 5.25 V, OFF: 0 - 0.8 V]
13	Dimming Control [0V:Min, 3.3V:Max] *Note(1)
14	External PWM Dimming [20~100%]

Note(1) If use Dimming Control, Pin 14 Must be N.C.

If use External PWM, Pin 13 Must be N.C.

## 4.3. Inverter Input Power Sequence



Note) SEQUENCE : On = Vin(24V) > Internal or External PWN ≥ Backlight On/off  
 OFF = Backlight On/Off ≥ Internal or External PWN > Vin(24V)

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## 4.4 LVDS Interface

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- LVDS Receiver : Tcon (merged)
- Data Format (JEIDA & Normal)

	LVDS pin	JEIDA -DATA	Normal -DATA
TxOUT/RxIN0	TxIN/RxOUT0	R2	R0
	TxIN/RxOUT1	R3	R1
	TxIN/RxOUT2	R4	R2
	TxIN/RxOUT3	R5	R3
	TxIN/RxOUT4	R6	R4
	TxIN/RxOUT6	R7	R5
	TxIN/RxOUT7	G2	G0
TxOUT/RxIN1	TxIN/RxOUT8	G3	G1
	TxIN/RxOUT9	G4	G2
	TxIN/RxOUT12	G5	G3
	TxIN/RxOUT13	G6	G4
	TxIN/RxOUT14	G7	G5
	TxIN/RxOUT15	B2	B0
	TxIN/RxOUT18	B3	B1
TxOUT/RxIN2	TxIN/RxOUT19	B4	B2
	TxIN/RxOUT20	B5	B3
	TxIN/RxOUT21	B6	B4
	TxIN/RxOUT22	B7	B5
	TxIN/RxOUT24	HSYNC	HSYNC
	TxIN/RxOUT25	VSNC	VSNC
	TxIN/RxOUT26	DEN	DEN
TxOUT/RxIN3	TxIN/RxOUT27	R0	R6
	TxIN/RxOUT5	R1	R7
	TxIN/RxOUT10	G0	G6
	TxIN/RxOUT11	G1	G7
	TxIN/RxOUT16	B0	B6
	TxIN/RxOUT17	B1	B7
	TxIN/RxOUT23	RESERVED	RESERVED

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#### 4.5 Input Signals, Basic Display Colors and Gray Scale of Each Color

COLOR	DISPLAY (8bit)	DATA SIGNAL																												GRAY SCALE LEVEL
		RED								GREEN								BLUE												
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7					
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-			
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-				
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-				
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-				
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-				
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-				
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-				
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-				
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0				
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1				
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2				
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			R3~ R252				
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:							
	↓ LIGHT	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R252			
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R252			
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R252			
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0				
	DARK ↑	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1				
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2				
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			G3~ G252				
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:							
	↓ LIGHT	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G252				
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G252				
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G252				
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0				
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B1				
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	B2				
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			B3~ B252				
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:							
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B252				
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B252				
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B252				

Note) Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

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## 5. Interface Timing

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### 5.1 Timing Parameters ( DE only mode )

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	NOTE
Clock	Frequency	$1/T_C$	72	78	85	MHz	-
Hsync		$F_H$	44	48	53	KHz	-
Vsync		$F_V$	50	60	66	Hz	-
Vertical Active Display Term	Display Period	$T_{VD}$	-	768	-	lines	-
	Vertical Total	$T_V$	776	802	1200	lines	-
Horizontal Active Display Term	Display Period	$T_{HD}$	-	1366	-	clocks	-
	Horizontal Total	$T_H$	1460	1624	2000	clocks	-

Note) This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

(1) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system

(2) Internal  $V_{DD} = 3.3V$

### 5.2 Spread Spectrum

- Modulation rate (max) :  $\pm 1.5 \%$
- Modulation Frequency : under 150 KHz

### 5.3 LVDS Input Data Position

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Input Data Position	$F_{IN}=85MHz$	$t_{RSRM}$	-	-	400	Ps	-
	$F_{IN}=78MHz$		-	-	450	ps	
	$F_{IN}=65MHz$		-	-	500	ps	
Input Data Position	$F_{IN}=85MHz$	$t_{RSLM}$	400	-	-	ps	
	$F_{IN}=78MHz$		450	-	-	ps	
	$F_{IN}=65MHz$		500	-	-	ps	
Input common mode voltage		$V_{CM}$	0.5	1.2	1.6	V	-
Differential Input Voltage		$ V_{ID} $	200	350	500	mV	-

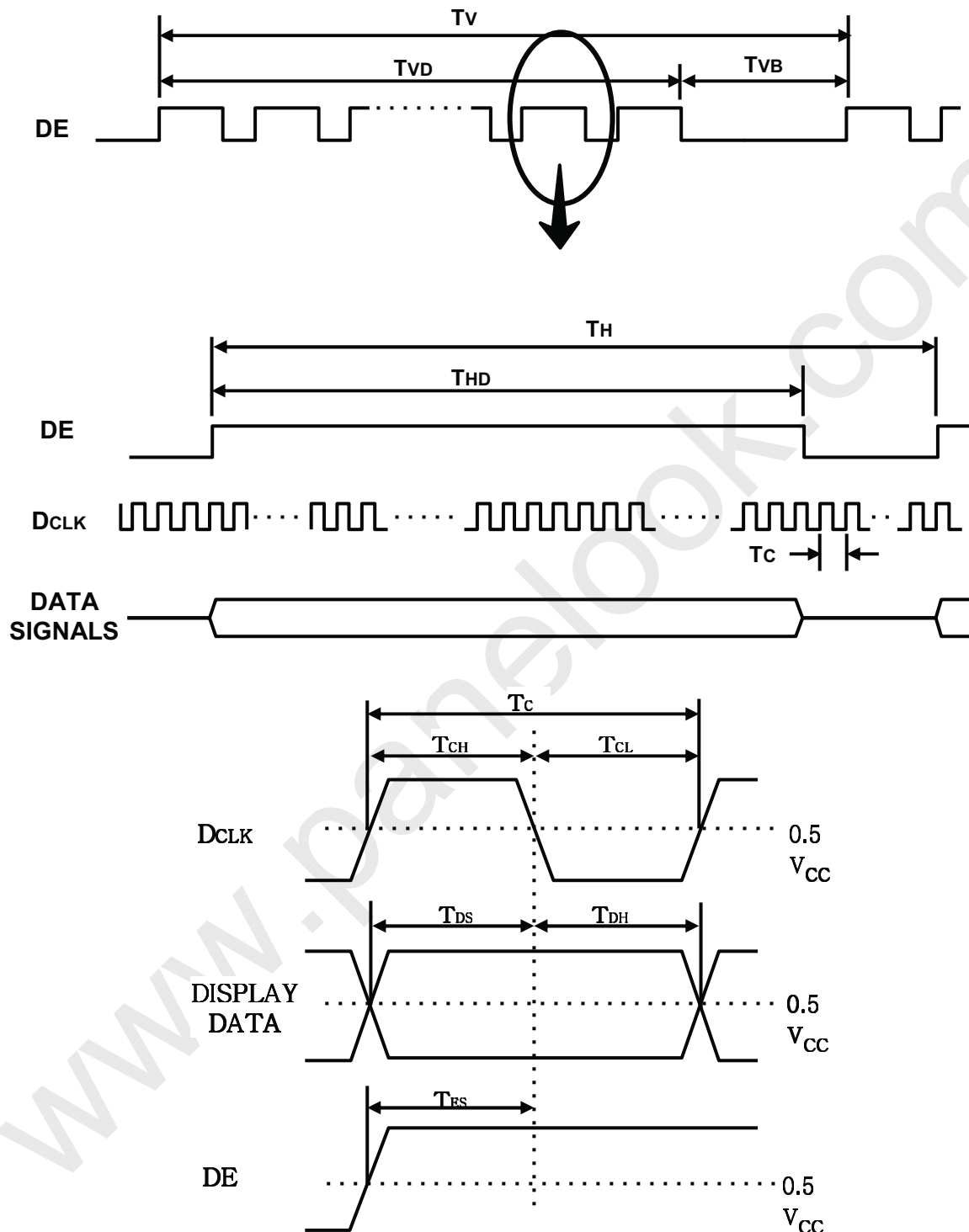
Note) When the skew is measured the Spread Spectrum should be 0%

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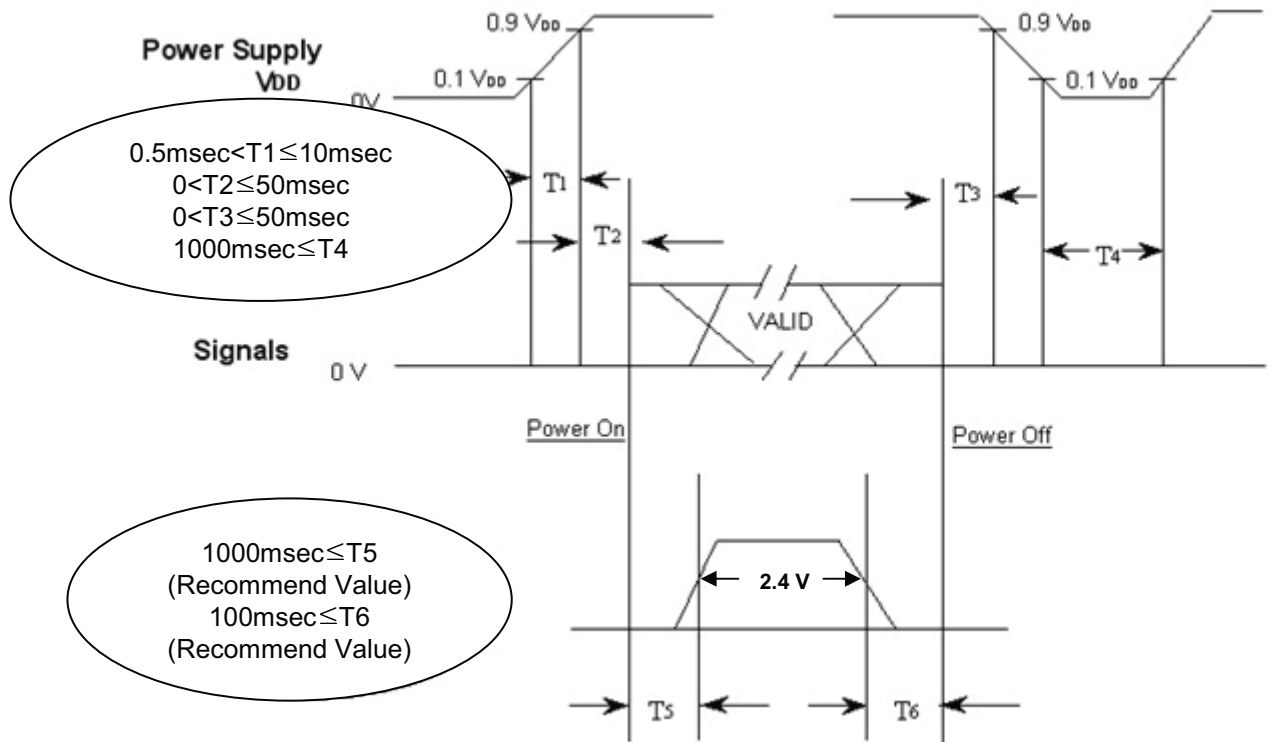
## 5.4 Timing diagrams of interface signal ( DE only mode )

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### 5.3 Power ON/OFF Sequence

To prevent a latch-up or DC operation of the LCD Module, the power on/off sequence should be as the diagram below.



T1 : V<sub>DD</sub> rising time from 10% to 90%

T2 : The time from V<sub>DD</sub> to valid data at power ON.

T3 : The time from valid data off to V<sub>DD</sub> off at power Off.

T4 : V<sub>DD</sub> off time for Windows restart

T5 : The time from valid data to B/L enable at power ON.

T6 : The time from valid data off to B/L disable at power Off.

- The supply voltage of the external system for the Module input should be the same as the definition of V<sub>DD</sub>.
- Apply the lamp voltage within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.
- In case of V<sub>DD</sub> = off level, please keep the level of input signals low or keep a high impedance.
- T4 should be measured after the Module has been fully discharged between power off and on period.
- Interface signal should not be kept at high impedance when the power is on.
- In case T5 is less than 1000msec and T6 is less than 100msec, Garbage Display can be seen.( It is not related to electrical function issue, Just for recommendation to prevent Garbage Display )

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